CLAIMS

1. A sensor system for detecting an effector or cofactor, comprising:

(a) a nucleic acid enzyme, comprising a cofactor binding site and optionally an effector binding site;

(b) substrates for the nucleic acid enzyme, comprising first polynucleotides;

(c) a first set of particles comprising second polynucleotides, wherein the polynucleotides are attached to the particles at the 3' terminus; and

(d) a second set of particles comprising third polynucleotides, wherein the polynucleotides are attached to the particles at the 5' terminus;

wherein the first polynucleotides comprise or are at least partially complementary to the second polynucleotides, and

the first polynucleotides comprise or are at least partially complementary to the third polynucleotides.

2. The sensor system of claim 1, wherein the nucleic acid enzyme comprises DNA.

3. The sensor system of claim 2, wherein the first set of particles and the second set of particles comprise gold.

4. The sensor of claim 2, wherein the first set of particles and the second set of particles comprise a material selected from the group consisting of metals, semiconductors and latex.

5. The sensor of claim 2, wherein the effector or cofactor is selected from the group consisting of nitrogen fertilizers, pesticides, dioxin, phenols, 2,4-dichlorophenoxyacetic acid, Pb(II), Hg(II), As(III), UO_2(II), Fe(III), Zn(II), Cu(II), Co(II), glucose, insulin, hCG-hormone, HIV, HIV proteins, anthrax, small pox, nerve gases, TNT, DNT, cocaine and antibiotics.

6. The sensor of claim 2, wherein:

the enzyme comprises a polynucleotide having a sequence of SEQ ID NO:1; and

the substrate comprises a polynucleotide having a sequence of SEQ ID NO:2.

7. The sensor of claim 2, wherein:

the nucleic acid enzyme comprises a polynucleotide having a sequence of SEQ ID NO:5 and a polynucleotide having a sequence of SEQ ID NO:6; and

the substrate comprises a polynucleotide of sequence of SEQ ID NO:4.

8. The sensor of claim 2, wherein:

the nucleic acid enzyme comprises a polynucleotide having a sequence of SEQ ID NO:8 and a polynucleotide having a sequence of SEQ ID NO:9; and

the substrate comprises a polynucleotide having a sequence of SEQ ID NO:7.

9. A method of detecting an effector or cofactor, comprising mixing the sensor of claim 1 with a sample.

10. The method of claim 9, further comprising analyzing the sample for a color change.

11. The method of claim 10, wherein the color change is at least 95 % complete 10 minutes after mixing.

12. The method of claim 9, wherein the mixing is carried out at a temperature of 10-45°C.

13. The method of claim 9, wherein the quantity of an analyte in the sample is inversely proportional to the formation or precipitation of aggregated particles.

14. The method of claim 13, wherein the formation or precipitation of aggregated particles is at least 95 % complete 10 minutes after mixing.

15. The method of claim 9, further comprising adding an ion selected from the group consisting of Mg(II), Ca(II), Zn(II), Mn (II), Co(II) and Pb(II).

16. The method of claim 9, wherein the sample comprises a biological sample.

17. A sensor system for detecting an effector or cofactor, comprising:

(a) a nucleic acid enzyme, comprising a cofactor binding site and optionally an effector binding site;

(b) substrates for the nucleic acid enzyme, comprising first polynucleotides;

(c) a first set of particles comprising second polynucleotides; and

(d) a second set of particles comprising third polynucleotides;

wherein the first polynucleotides comprise or are at least partially complementary to the second polynucleotides,

the first polynucleotides comprise or are at least partially complementary to the third polynucleotides, and

the second set of particles have a diameter of at least 20 nm.

18. The sensor system of claim 17, wherein the second set of particles have a diameter of at least 30 nm.

19. The sensor system of claim 18, wherein the nucleic acid enzyme comprises DNA.

20. The sensor system of claim 18, wherein the first set of particles and the second set of particles comprise gold.

21. The sensor of claim 18, wherein the first set of particles and the second set of particles comprise a material selected from the group consisting of metals, semiconductors and latex.

22. The sensor of claim 18, wherein the effector or cofactor is selected from the group consisting of nitrogen fertilizers, pesticides, dioxin, phenols, 2,4-dichlorophenoxyacetic acid, Pb(II), Hg(II), As(III), UO_2(II), Fe(III), Zn(II), Cu(II), Co(II), glucose, insulin, hCG-hormone, HIV, HIV proteins, anthrax, small pox, nerve gases, TNT, DNT, cocaine and antibiotics.

23. The sensor of claim 18, wherein:

the enzyme comprises a polynucleotide having a sequence of SEQ ID NO:1; and

the substrate comprises a polynucleotide having a sequence of SEQ ID NO:2.

24. The sensor of claim 18, wherein:

the nucleic acid enzyme comprises a polynucleotide having a sequence of SEQ ID NO:5 and a polynucleotide having a sequence of SEQ ID NO:6; and

the substrate comprises a polynucleotide having a sequence of SEQ ID NO:4.

25. The sensor of claim 18, wherein:

the nucleic acid enzyme comprises a polynucleotide having a sequence of

SEQ ID NO:8 and a polynucleotide having a sequence of SEQ ID NO:9; and

the substrate comprises a polynucleotide having a sequence of SEQ ID NO:7.

26. A method of detecting an effector or cofactor, comprising mixing the sensor of claim 17 with a sample.

27. The method of claim 26, further comprising analyzing the sample for a color change.

28. The method of claim 27, wherein the color change is at least 95 % complete 10 minutes after mixing.

29. The method of claim 26, wherein the mixing is carried out at a temperature of 10-45 °C.

30. The method of claim 26, wherein the quantity of an analyte in the sample is inversely proportional to the formation or precipitation of aggregated particles.

31. The method of claim 26, wherein the formation or precipitation of aggregated particles is 95 % complete 10 minutes after mixing.

32. The method of claim 30, further comprising adding an ion selected from the group consisting of Mg(II), Ca(II), Zn(II), Mn (II), Co(II) and Pb(II).

33. The method of claim 26, wherein the sample comprises a biological sample.

34. A method of detecting an effector or cofactor in a sample, comprising:

mixing together at least:

(a) a nucleic acid enzyme, comprising a cofactor binding site and optionally an effector binding site;

(b) substrates for the nucleic acid enzyme, comprising first polynucleotides;

(c) a first set of particles comprising second polynucleotides;

(d) a second set of particles comprising third polynucleotides; and

(e) the sample;

to form a mixture,

wherein the first polynucleotides comprise or are at least partially complementary to the second polynucleotides,

the first polynucleotides comprise or are at least partially complementary to the third polynucleotides, and

the mixture produces a color change indicating the presence of the effect or cofactor in the sample within 10 minutes of forming the mixture, without heating.

35. The method of claim 34, wherein the nucleic acid enzyme comprises DNA.

36. The method of claim 34, wherein the first set of particles and the second set of particles comprise gold.

37. The method of claim 34, wherein the first set of particles and the second set of particles comprise a material selected from the group consisting of metals, semiconductors and latex.

38. The method of claim 34, wherein the effector or cofactor is selected from the group consisting of nitrogen fertilizers, pesticides, dioxin, phenols, 2,4-dichlorophenoxyacetic acid, Pb(II), Hg(II), As(III), UO_2(II), Fe(III), Zn(II), Cu(II), Co(II), glucose, insulin, hCG-hormone, HIV, HIV proteins, anthrax, small pox, nerve gases, TNT, DNT, cocaine and antibiotics.

39. The method of claim 34, wherein:

the enzyme comprises a polynucleotide having a sequence of SEQ ID NO:1; and

the substrate comprises a polynucleotide having a sequence of SEQ ID NO:2.

40. The method of claim 34, wherein:

the nucleic acid enzyme comprises a polynucleotide having a sequence of SEQ ID NO:5 and a polynucleotide having a sequence of SEQ ID NO:6; and

the substrate comprises a polynucleotide of sequence of SEQ ID NO:4.

41. The method of claim 34, wherein:

the nucleic acid enzyme comprises a polynucleotide having a sequence of SEQ ID NO:8 and a polynucleotide having a sequence of SEQ ID NO:9; and

the substrate comprises a polynucleotide having a sequence of SEQ ID NO:7.